Amendments to the Specification

Please replace the paragraph beginning at page 1, line 1, with the following rewritten paragraph:

--**Cross-References to Related Applications**

This application is related to U.S. Application Serial No. 09/750,820, filed December 28, 2000 and now Patent No. 6,499,980, which is expressly incorporated by reference herein in its entirety.--

Please replace the paragraph beginning at page 8, line 8, with the following rewritten paragraph:

--According to the principles of the invention, an apparatus is provided which includes a melt spinning apparatus and an air management system having three air handlers. The melt spinning apparatus is operative to extrude filaments of material and is positioned vertically above a collector. A first air handler of the air management system is positioned directly below the melt spinning apparatus in a forming zone. A second air handler is positioned upstream of the ~~second~~ first air handler and the forming zone. A third air handler is positioned downstream of the ~~second~~ first air handler and the forming zone. The second and third air handlers each include an air-directing member, as described above, and an adjustable flow control device, also as described above.--

Please replace the paragraph beginning at page 8, line 19, with the following rewritten paragraph:

--According to the principles of the present invention, an apparatus is provided that is configured to discharge filaments of material onto a moving collector. The apparatus includes a melt spinning apparatus operative for extruding filaments, a filament drawing device positioned between the melt spinning apparatus and the collector, and an air handler having an intake opening positioned proximate to the collector. The filament drawing device has an inlet for receiving the filaments from the melt spinning apparatus and an outlet for discharging the filaments toward the collector. The filament drawing device is operative for providing a flow of process air sufficient to attenuate the filaments of material. The flow of process air entrains secondary air from the ambient environment between the outlet and the collector. The intake opening of the air handler collects process air discharged from the filament drawing device and secondary air entrained by the process air. The apparatus further includes a forming chamber having a side wall at least partially surrounding the intake opening of the air handler and the outlet of the filament drawing device, an entrance opening ~~downstream~~ upstream of the intake opening, and an exit opening ~~upstream~~ downstream of the intake opening. The side wall defines a process space for the passage of the filaments of material from the outlet of the filament drawing device to the collector and partitions the process space from the surrounding ambient environment. The entrance and exit openings are dimensioned so that at least the collector can traverse the process space.

The side wall of the forming chamber includes a perforated metering sheet configured to regulate the flow of air from the ambient environment into the process space.--

Please replace the paragraph beginning at page 11, line 10, with the following rewritten paragraph:

--While the air management system 12 has been illustrated in conjunction with the two-station production line 10, the air management system 12 is generally applicable to other production lines having a single station or a plurality of stations. In a single station production line, the nonwoven web can be manufactured using any one of a number of ~~process~~ processes, such as a meltblowing process or a spunbonding process. In a multiple-station production line, a plurality of nonwoven webs can be manufactured to form a multilayer laminate or composite. Any combination of meltblowing and spunbonding processes may be used to manufacture the laminate. For instance, the laminate may include only nonwoven meltblown webs or only nonwoven spunbonded webs. However, the laminate may include any combination of meltblown webs and spunbonded webs, such as ~~an spinbond/meltblown/spinbond~~ a spunbond/meltblown/spunbond (SMS) laminate.--

Please replace the paragraph beginning at page 13, line 1, with the following rewritten paragraph:

--The airborne curtain of filaments 26 exits the quenching system 28 and is directed by suction, along with a large volume of secondary air from the surrounding environment, into an inlet 29 of a filament drawing device 30. The filament drawing device 30 envelops the filaments 26 with a high velocity flow of process air directed generally parallel to the length of the filaments 26 for applying a biasing or tensile force in a direction substantially parallel to the length of the filaments 26. The filaments 26 are extensible and the high velocity flow of process air in the filament drawing device 30 attenuates and molecularly orients the filaments 26. The attenuated filaments 26 are entrained in the high velocity process air and secondary air when ejected from an outlet 34 of the filament drawing device 30. The mixture of attenuated filaments 26 and high velocity air will be referred to hereinafter as a ~~filament/air or~~ filament/air mixture 33. The filament/air mixture 33 enters a forming chamber 31, which is provided above the collector 32, and the attenuated filaments 26 in the filament/air mixture 33 are propelled toward the collector 32. The filament drawing device 30 may be mounted on a vertically movable fixture (not shown) for adjustment, as indicated generally by the arrow on Figure 1, of the vertical spacing between the outlet 34 and the collector 32 among various vertical spacings.--

Please replace the paragraph beginning at page 14, line 3, with the following rewritten paragraph:

--According to the present invention, the air management system 12 includes a pair of spill air control rollers 38, 40, which have a spaced relationship in a direction parallel to the machine direction 15. Defined in the machine direction 15 between spill air control rollers 38, 40 is a forming zone 35 flanked on the upstream side by a pre-forming zone 36 and on the downstream side by a post-forming zone 37. The zones 35, 36, 37 extend lengthwise across the width of the air management system 12 in the cross-machine direction 17. Most of the filaments 26 in the filament/air mixture 33 are deposited on the collector 32 in the forming zone 35. The entraining process air of the filament/air mixture 33 passes through the spunbonded web 20 as it forms and thickens, the collector 32, and any pre-existing substrate on collector 32 for collection by the forming zone 35, pre-forming zone 36 and post-forming zone 37. The collector 32 is perforated so that the process air from the filament/air mixture 33 flows through the collector 32 and into the air management system 12. The process air at spunbonding station 14 is then evacuated by controlled vacuum or negative pressure supplied by the air management system 12. The vacuum in pre-forming zone 36 is selectively controlled by a pair of spill air control valves 41, 42 <u>(Fig. 8)</u> and, similarly, the vacuum pressure in the post-forming zone 37 is selectively controlled by a pair of spill air control valves 43, 44 <u>(Fig. 8)</u>.--

Please replace the paragraph beginning at page 16, line 19, with the following rewritten paragraph:

--With further reference to Figs. 2 and 3, air management system 12 includes three discrete air handlers 52, 54, 56 disposed directly below the collector [[34]] 32. Air handlers 52, 54, 56 include intake openings 58, 60, 62 and oppositely disposed exhaust openings 64, 66, 68. Individual exhaust conduits 70, 72, 74 are connected respectively to exhaust openings 64, 66, 68. Exhaust conduit 70, which is representative of exhaust conduits 72, 74, is comprised of a series of individual components including first elbows 76, second elbows 78, and elongated portion 80. In operation, any suitable air moving device (not shown), such as a variable speed blower or fan, is connected by suitable ducts to elongated portion 80 to provide suction, vacuum or negative pressure for drawing the process air through the air management system 12.--

Please replace the paragraph beginning at page 17, line 5, with the following rewritten paragraph:

--With continued reference to Figs. 2 and 3, air handler 54 is located directly below the forming zone 35. As such, air handler 54 collects and disposes of the largest portion of the process air used during the extrusion and filament-forming processes to form spunbonded web 20 and the secondary air entrained therewith. The pre-forming zone 36 of the upstream air handler [[56]] 52 and the post-forming zone 37

of the downstream air handler [[52]] <u>56</u> collect spillover air which air ~~handle~~ <u>handler</u> 54 does not collect.--

Please replace the paragraph beginning at page 17, line 12, with the following rewritten paragraph:

--With reference now to Figs. 4-6, forming zone air handler 54 has an outer housing 94, which includes intake opening 60 and oppositely disposed exhaust openings 66. Intake opening 60 includes a perforated cover 96 with a series or grid of apertures through which the combined process and secondary air flows. Depending [[of]] <u>on</u> the manufacturing parameters, air handler 54 may be operated without using the perforated cover 96 at all. Air handler 54 further includes an inner housing or box 98 which is suspended from the outer housing 94 by means of spacing members 100 which include a plurality of openings 101 therein. Two filter members 102, 104 are selectively removable from air handler 54 so that they may be periodically cleaned. The filter members 102, 104 slide along stationary rail members 106, 108. Each of these filter members 102, 104 are perforated with a series of apertures through which the combined process and secondary air flows.--

Please replace the paragraph beginning at page 20, line 3, with the following rewritten paragraph:

--As illustrated in Fig. 3, the intake openings 58, 62 of air handlers 52, 56 are significantly wider in the machine direction 15 than intake opening 60 of air handler 54. However, intake openings 58, 62 are divided in the machine direction 15 ~~is altered~~ by the presence of spill air control rollers 38, 40. ~~Specifically~~ <u>As best shown in Fig. 8</u>, the negative pressure area of the intake opening 58 is divided into two discrete zones, an upstream zone 57 upstream in the machine direction 15 from spill air control roller 38 and the pre-forming zone 36. Similarly, the negative pressure area of intake opening 62 is divided into two discrete zones, a downstream zone 59 downstream in the machine direction 15 from the spill air control roller 40 and the post-forming zone 37.--

Please replace the paragraph beginning at page 20, line 14, with the following rewritten paragraph:

--Because of the substantial similarity of air handlers [[51,]] <u>52 and</u> 56, the following description of air handler 52 applies equally to air handler 56. With reference to Figs. 7 and 8, air handler 52 has an outer housing 136 which includes intake opening 58 and exhaust openings 64. Intake opening 58 includes a perforated cover 135 with a series of fine apertures through which the process air and entrained secondary air flows. Depending on the manufacturing parameters, perforated cover 135 may be eliminated from air handler 52.--

Please replace the paragraph beginning at page 20, line 21, with the following rewritten paragraph:

--Air handler 52 further includes an inner housing or box 138 that is suspended from the outer housing 136 by multiple latticed dividers 140 having a spaced-apart relationship in the cross-machine direction 17. A flow chamber 141 (Fig. 8) is created in the substantially open volume between the intake opening 58 (Fig. 7) and an upper wall 143 of the inner box 138. Spaced-apart vertical air plenums 137, 139 (Fig. 8) are created by respective spaced-apart gaps in the machine direction 15 between the inner box 138 and the outer housing 136. Air plenum 137 has an air inlet port 128 coupled in fluid communication with flow chamber 141, and air plenum 139 has an air inlet port 130 coupled in fluid communication with flow chamber 141. Each of the latticed dividers 140 includes a plurality of openings 142 that couple the various ~~potions~~ portions of the flow chamber 141 partitioned by dividers 140. The latticed dividers 140 participate in equalizing the flow of process and secondary air from the intake opening 58 to plenums 137, 139 and operate to disrupt turbulent flow. Air plenum 137 includes latticed dividers 132 and air plenum 139 includes latticed dividers 134 in which dividers 132, 134 have a similar function as latticed dividers 140.--

Please replace the paragraph beginning at page 21, line 13, with the following rewritten paragraph:

--With continued reference to Figs. 7 and 8, the inner box 138 includes a bottom panel 144 spaced vertically from the outer housing 136 to define a horizontal air plenum 145 (Fig. 8) having opposite open ends respectively coupled in fluid communication with air plenums 137, 139. The bottom panel 144 includes an aperture or slot 146 that is configured similarly to slot 112 and that couples the air plenum 145 in fluid communication with the interior of inner box 138. Slot [[112]] 146 is operative to direct air arriving via plenums 137, 139, 145 into the interior of inner box 138. An inner periphery of slot 146 includes ends 148, 149 and center portion 150. Like slot 112, the width at center portion 150 of slot 146 is greater than the width at ends 148, 149. Air is exhausted from the interior of the inner box 138 via exhaust openings 64 (Figs. 1 and 3). It is appreciated that air handler 52 is representative of air handler 56 so that like features are labeled with like reference numerals in Fig. 8.--

Please replace the paragraph beginning at page 22, line 10, with the following rewritten paragraph:

--A smooth-surface anvil or support roller 152 is located below the collector 32 and extends in the cross-machine direction 17 across the length of the intake opening 58. The support roller 152 is positioned vertically relative to the spill air control roller 38 by a distance sufficient to provide an entrance opening 131 for collector 32 and any substrate residing thereupon. The rollers 38, 152 frictionally engage collector 32 and rotate in opposite directions as collector 32 is conveyed into the forming chamber 31 of ~~spunbonded station 12~~ spunbonding station 14. This spatial relationship between the collector 32, the spill air control roller 38, and the support roller

152 significantly reduces the aspiration of secondary air from the surrounding environment of forming chamber 31 that might otherwise disturb fiber laydown on the collector 32 inside the forming chamber 31 while allowing entry of the collector 32 and any substrate residing thereupon into the process space [[141]] 171.--

Please replace the paragraph beginning at page 23, line 4, with the following rewritten paragraph:

--Similarly, spill air control roller 40 is mounted for free rotation to the forming chamber 31 by a shaft 153 and an anvil or support roller 154 that operates in conjunction with spill air control roller 40 to define post-forming zone 37 by dividing intake opening 62 of air handler [[58]] 56. Collector 32 and spunbonded substrate 20 formed by spunbonding station 14 exit the forming chamber 31 by passing through an exit opening 133 provided between roller 40 and roller 154. Spill air control roller 40 has similar attributes as spill air control roller 38 and hence the above description of control roller 38 applies equally to control roller 40. It is apparent that the spill air control rollers 38, 40 and support rollers 152, 154 provide guide surfaces spaced in the machine direction 15 which guide the filament/air mixture 33 (Fig. 1) to target zones 35, 36, 37.--

Please replace the paragraph beginning at page 23, line 15, with the following rewritten paragraph:

--With reference to Fig. 8 and continuing to describe spillover air handler 52 with the understanding that the description is equally applicable to air handler 56, spill air control valve 41 is positioned in flow chamber 141 proximate to air inlet port 128 of vertical air plenum [[137]] 139 and spill air control valve 42 is positioned in flow chamber 141 proximate to air inlet port 130 of vertical air plenum [[139]] 137. Spill air control valves 41 and 42 are selected from any of numerous mechanical devices by which the flow of air may be regulated by a movable part that partially obstructs one or more ports or passageways.--

Please replace the paragraph beginning at page 23, line 23, with the following rewritten paragraph:

--Spill air control valves 41 and 42 are illustrated in Fig. 8 as having a butterfly valve structure, although the present invention is not so limited. Spill air control valve 41 comprises a shutter 156, which may be rectangular, extending in the cross-machine direction 17 and a rotatable shaft 157 to which shutter 156 is diametrically attached. Spill air control valve 41 regulates the flow of process air into air inlet port 128 of vertical air plenum [[137]] 139. Specifically, the shaft 157 is rotatable about an axis of rotation extending in the cross-machine direction 17 along its length so that shutter 156 can regulate the flow of process air into vertical air plenum [[137]] 139. The rotational orientation of shutter 156 at least partially determines the flow resistance of process air being evacuated through intake opening 58 upstream of spill air control roller 38 and into vertical air plenum [[137]] 139.--

Please replace the paragraph beginning at page 24, line 10, with the following rewritten paragraph:

--Similarly, spill air control valve 42 includes a shutter 158 extending in the cross-machine direction 17 and a rotatable shaft 159 to which shutter 158 is diametrically attached. Spill air control valve 42 regulates the flow of process air into air inlet port 130 of vertical air plenum [[139]] 137. Specifically, the shaft 159 is rotatable about an axis of rotation extending along its length so that shutter 158 can regulate the flow of process air into vertical air plenum [[139]] 137. The rotational orientation of shutter 158 at least partially determines the flow resistance (i.e., air volume and velocity) of process air being evacuated through intake opening 58 downstream of control roller [[40]] 38 in pre-forming zone 36 and into vertical air plenum [[139]] 137. Regulation of the flow resistance with spill air control valves 41, 42 regulates the negative air pressure or vacuum applied in pre-forming zone 36. The spill air control valves 41, 42 further regulate the negative air pressure or vacuum applied upstream of the spill air control roller [[40]] 38 in upstream zone 57 for holding any material on the collector 32 in intimate contact therewith.--

Please replace the paragraph beginning at page 25, line 1, with the following rewritten paragraph:

--With continued reference to Fig. 8, spill air control valves 43, 44 of air handler 56 have a similar construction to spill air control valves 41, 42 and function

similarly for selectively regulating the negative air pressure in the post-forming zone 37 and upstream of spill air control roller [[38]] 40 in downstream zone 59. The application of negative air pressure upstream of spill air control roller [[38]] 40 in post-forming zone 37 is particularly important for controlling the accumulation of freshly-deposited filaments 26 on the outer peripheral surface of the roller [[38]] 40.--

Please replace the paragraph beginning at page 25, line 17, with the following rewritten paragraph:

--The collection efficiency for the filaments 26 on collector 32 is a function of several characteristics of the filament/air mixture 33, including the temperatures of the air and filaments 26, the air velocity, and the air volume. The spill air control valves 41-44 may be adjusted to match the vacuum pressures in at least zones 35, 36, 37 for optimizing the collection efficiency. The vacuum pressures will differ in each of zones 35, 36 and 37 due to differing pressure drops across the thickness of the overlying material, including the collector 32, any substrate thereupon and the spunbonded web 20. Although the vacuum pressures must be sufficient for evacuating the process air, the vacuum pressures must not be so great as to compress the spunbonded web 20 as it is formed on collector 32. The spill air control valves 41-44 are configured and/or dimensioned such that the ~~distribution~~ distributions of air flow velocities in the cross-machine direction 17 are not significantly effected by their presence adjacent the vertical air plenums 137, 139.--

Please replace the paragraph beginning at page 26, line 6, with the following rewritten paragraph:

--As mentioned above, the flow path of process and entrained secondary air through air handler 52 is similar to the flow path of process and entrained secondary air in air handler 56. With reference to Figs. 7 and 8 and as described with regard to air handler 52, process and secondary air enters flow chamber 141 through intake opening 58 and perforated cover [[137]] 135, as illustrated by arrows 160, and passes through the vertical air plenums 137, 139, as illustrated by arrows 161. The vacuum pressure controlling the individual flows of air into vertical air plenums 137, 139 is selected by orienting spill air control valves [[41, 42]] 42, 41 to vary the flow resistance to plenums 137, 139, respectively. The air then enters the interior of inner box 138 through slot 146, as illustrated by arrow 162. Finally, the air exits the inner box 138 through exhaust opening 64 as illustrated by arrow 163 and then travels through exhaust conduit 70. The openings 142 in ~~spacing members~~ latticed dividers 140 allow the air to move in the cross-machine direction 17 to minimize transverse pressure gradients.--

Please replace the paragraph beginning at page 27, line 7, with the following rewritten paragraph:

--Generally, the metering sheet 166 is any structure operative to regulate the fluid communication between the surrounding ambient environment and the process space 171 inside the forming chamber 31 between the filament drawing device 30 and collector 32. To that end, penetrating through the thickness of the metering sheet 166

is a plurality of holes or pores 168 arranged with a spaced-apart relationship in a random pattern or in a grid, array, matrix or other ordered arrangement. Typically, the pores 168 are symmetrically arranged for providing a symmetrical aspiration of secondary air in the machine direction 15 and in the cross-machine direction 17 from the ambient environment surrounding the forming chamber 31. The pores 168 typically have a circular cross-sectional profile but may be, for example, polygonal, elliptical or slotted. The pores 168 may have a single, uniform cross-sectional area or may have [[a]] various cross-sectional areas distributed to produce a ~~desire~~ desired flow of secondary air into the space between the filament drawing device 30 and the forming chamber 31. For a circular cross-sectional profile, the average diameter of the pores 168 is less than about 500 microns and, typically, ranges between about 50 microns to about 250 microns. The pattern of pores 168 may be determined by, for example, a fluid dynamics calculation or may be randomly arranged to provide the desired flow characteristics. The metering sheet 166 may be, for example, a screen or sieve, a drilled, stamped or otherwise produced apertured thin metal plate, or a gas permeable mesh having interconnected gas passageways extending through its thickness.--

Please replace the paragraph beginning at page 28, line 5, with the following rewritten paragraph:

--The metering sheet 166 is characterized by the porosity or the ratio of the total cross-sectional area of the pores 168 to the ratio of the remaining unperforated part of the [[plate]] sheet 166. The pores 168 of the metering sheet 166 ~~provides~~

provide significant regulation of the flow of secondary air from the surrounding ambient environment induced by aspiration through the [[plate]] sheet 166 and captured by the filament/air mixture 33. The porosity of the metering sheet 166 is characterized by, among other parameters, the number of pores 168, the pattern of the pores 168, the geometrical shape of each pore 168, and the average pore diameter. Typically, the ratio of the total cross-sectional area of the pores 168 to the ratio of the remaining unperforated part of the [[plate]] sheet 166 ranges from about 10% to about 80%.--

Please replace the paragraph beginning at page 29, line 18, with the following rewritten paragraph:

--With reference to Figs. 9 and 10, one embodiment of the filament drawing device 30 includes a first process air manifold 170 and a second process air manifold 172 movably attached to the process air manifold 170 by a bracket 174. Each of the process air manifolds 170 and 172 includes a cylindrical flow chamber 176 that extends in the cross-machine direction 17 between a flanged inlet fitting 178 at one end and a flanged exhaust fitting 180 at an opposite end. A flow of temperature-controlled process air is established in each flow chamber 176 between the inlet and exhaust fittings 178, 180. To that end, a pressurized process air supply 182 is coupled in fluid communication with inlet fitting 178 by an air supply conduit 183. A portion of the process air is directed in the filament drawing device 30 so as to attenuate the filaments 26, as will be described below. Residual process air is exhausted from each flow chamber 176 to a waste gas sink 184 [[from]] via an air exhaust conduit 185 connected to ~~outlet~~ exhaust fitting 180. Typically, the process air supply 182 provides process air

at a pressure of about 5 pounds per square inch (psi) to about 100 psi, typically within the range of about 30 psi to about 60 psi, and at a temperature of about 60°F to about 85°F.--

Please replace the paragraph beginning at page 31, line 7, with the following rewritten paragraph:

--With continued reference to Figs. 9-10, process air manifold 170 is movable relative to the process air manifold 172 in the machine direction 15 for varying the width of the channel 190 of flow passageway 186. To that end, process air manifold 170 is movable mounted to the bracket 174 and a pair of electro-pneumatic cylinders 194, 195 are provided that are operative for providing motive power to move process air manifold 170 relative to process air manifold 172. The electro-pneumatic cylinders 194, 195 may vary the width of the channel 190, which alters the properties of the ~~fibers~~ filaments26 and filament/air mixture 33. In preparation for operation, the width of channel 190 may be varied from about 0.1 mm to about 6 mm and, for most applications, is adjusted so that the separation between the process air manifolds 170, 172 is between about 0.2 mm and about 2 mm. Process air manifold 170 may also be moved a greater distance from process air manifold 172, such as about 10 cm to about 15 cm, to enhance the access to the flow passageway 186 for maintenance events such as removing resin residues and other debris that accumulate during use.--

Please replace the paragraph beginning on page 34, line 3, with the following rewritten paragraph:

--The filament drawing device 30 of the present invention operates at a lesser pressure than conventional filament drawing devices while providing a comparable or improved fiber attenuation. Although the pressure of the process air is reduced, the filament drawing device 30 is highly efficient and the velocity of the filaments 26 in the filament/air mixture 33 is adequate to ensure high-quality fiber laydown for forming spunbonded web 20. In particular, the filament drawing device 30 provides spinning speeds, as represented by the linear velocities for filaments 26, that range from 8,000 m/min up to about 12,000 m/min. The reduction in the pressure of high-velocity process air exiting the outlet 34 also reduces the entrained volume of secondary air from the ambient environment ~~surrounding~~ between the outlet 34 of the filament drawing device 30 and the collector 32. According to principles of the present invention, filament drawing device 30 enhances the spinning speed while simultaneously reducing the volume of secondary and process air that the air management system 12 must manage and, in doing so, enhances the characteristics of the spunbonded web 20 formed on collector 32.--

Please replace the paragraph beginning at page 36, line 1, with the following rewritten paragraph:

--The resin used to fabricate the spunbonded web 20 formed by spunbonding station 14 can be any of the commercially available spunbond grades of a wide range ~~thermoplastic~~ <u>of</u> thermoplastic polymeric materials including without

limitation polyolefins, polyamides, polyesters, polyamides, polyvinyl acetate, polyvinyl chloride, polyvinyl alcohol, cellulose acetate, and the like. Polypropylene, because of its availability and low relative cost, is a common thermoplastic resin used to form spunbonded web 20. The filaments 26 used in making spunbonded web 20 may have any suitable morphology and may include hollow or solid, straight or crimped, single component, bi-component or multi-component fibers or filaments, and blends or mixes of such fibers and/or filaments, as are well known in the art. To produce bi-component and multi-component filaments and/or fibers, for example, the melt spinning assembly 24 and the extrusion die 25 are adapted to extrude multiple types of thermoplastic resins. An exemplary melt spinning assembly 24 and extrusion die 25 having a spin pack capable of extruding multi-component filaments to form multi-component spunbonded webs 20 is described in commonly-assigned, co-pending U.S. Patent Application Serial No. 09/702,385, now Patent No. 6,478,563, entitled "Apparatus for Extruding Multi-Component Liquid Filaments" and filed October 31, 2000.--